

Translation

PATENT COOPERATION TREATY

PCT/JP2004/004512



PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PH-2063-PCT	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/JP2004/004512	International filing date (day/month/year) 30 March 2004 (30.03.2004)	Priority date (day/month/year) 31 March 2003 (31.03.2003)
International Patent Classification (IPC) or national classification and IPC H01L 27/105, 43/08		
Applicant JAPAN SCIENCE AND TECHNOLOGY AGENCY		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
  - a. ☐ (sent to the applicant and to the International Bureau) a total of \_\_\_\_\_ sheets, as follows:
    - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - b. ☐ (sent to the International Bureau only) a total of \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input checked="" type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

Date of submission of the demand 01 October 2004 (01.10.2004)	Date of completion of this report 28 April 2005 (28.04.2005)
Name and mailing address of the IPEA/JP	Authorized officer
Facsimile No.	Telephone No.

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP2004/004512

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_, which is language of a translation furnished for the purpose of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

- ☒ The international application as originally filed/furnished
- ☐ the description:
- pages \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ the claims:
- pages \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_, as amended (together with any statement) under Article 19
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ the drawings:
- pages \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (specify): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (specify): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (specify): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (specify): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. IV Lack of unity of invention

1. ☐ In response to the invitation to restrict or pay additional fees the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted nor paid additional fees.
2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☒ not complied with for the following reasons:

Document 1: LeClair, P. et al., "Large magnetoresistance using hybrid spin filter devices," Appl. Phys. Lett. January 28, 2002 (01.28.02), Vol. 80, No. 4, pages 625-627

Document 2: MATSUKURA, F. et al., "Control of ferromagnetism in field-effect transistor of a magnetic semiconductor," Physica E, Vol. 12, Issues, January 2002, pages 351-355

In order to satisfy the requirement of unity of the group of inventions described in the claims, there must be special technical features so that the group of inventions is so linked as to form a single general inventive concept. The group of inventions described in claims 1-99 is found to relate to one another only by a "ferromagnetic body" provided between a source and drain. However, given that this matter is described in document 1 (in particular, Figs. 1 and 2, and sections explaining drawings) and document 2 (in particular, Fig. 1 and sections explaining drawings), it cannot be a special technical feature.

Thus, among the group of inventions described in claims 1-99, there is no special technical feature so linked as to form a single general inventive concept. Therefore, the group of inventions described in claims 1-99 clearly does not satisfy the requirement of unity of invention.

4. Consequently, this report has been established in respect of the following parts of the international application:

- ☒ all parts.
- ☐ the parts relating to claims Nos. \_\_\_\_\_

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims	1-33, 36-99	YES
	Claims	34, 35	NO
Inventive step (IS)	Claims		YES
	Claims	1-99	NO
Industrial applicability (IA)	Claims	1-99	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

Document 1: LeClair, P. et al., "Large magnetoresistance using hybrid spin filter devices," Appl. Phys. Lett. January 28, 2002 (01.28.02), Vol. 80, No. 4, pages 625-627

Document 2: MATSUKURA, F. et al., "Control of ferromagnetism in field-effect transistor of a magnetic semiconductor," Physica E, Vol. 12, Issues, January 2002, pages 351-355

Document 3: JP, 11-238924, A (Toshiba Corporation), August 31, 1999 (08.31.99)

Document 4: JP, 2001-250998, A (President of Tohoku University), September 14, 2001 (09.14.01)

Document 5: Satoshi SUGAWARA et al., "Spin Filter Transistor no Teian to Sono Oyo," Dai 50 Kai Oyo Butsurigaku Kankei Rengo Koenkai Koen Yokoshu, March 27, 2003 (03.27.03), No. 3, page 1566, 30a-ZH-1, Full text

The inventions relating to claims 1-11 and 12 do not appear to involve an inventive step based on documents 1, 3, 4 and 5. Applying a ferromagnetic tunnel barrier of documents 1 and 5 in which an energy band end of a carrier is spin split to a transistor tunnel barrier of documents 3 and 4 would be easy.

The inventions relating to claims 13-14 and 15-16 do not appear to involve an inventive step based on documents 1, 3, 4 and 5. How to direct a bonded surface of a bonding structure with a tunnel barrier with respect to a substrate is a matter of design variation for a party skilled in the art.

The inventions relating to claims 17-33 do not appear to involve an inventive step based on documents 1, 3, 4 and 5. Applying a spin transistor to a storage element and storage circuit is described in documents 3 and 4, and a wiring structure and the like for a storage element and storage circuit falls in a matter of design variation for a party skilled in the art.

The invention relating to claim 34 does not appear to be novel or involve an inventive step based on document 1. A structure comprising a ferromagnetic tunnel barrier of document 1 (Fig. 1) corresponds to a "two terminal magnetic resistance element" of the present claims.

The invention relating to claim 35 does not appear to be novel or involve an inventive step based on document 2 (Fig. 1 and sections explaining drawings).

The inventions relating to claims 36-38, 39, 40, 41-43, 44 and 45-71 do not appear to involve an inventive step based on documents 1, 2, 3, 4 and 5. Documents 1 and 5 should be referred to regarding a ferromagnetic body tunnel barrier, and documents 3 and 4 regarding a transistor using a tunnel barrier. Also, how to direct a bonded surface of a bonding structure with a tunnel barrier with respect to a substrate is a matter of design variation for a party skilled in the art.

The inventions relating to claims 72-99 do not appear to involve an inventive step based on documents 1, 2, 3, 4 and 5. Applying a spin transistor to a storage element and storage circuit is described in documents 3 and 4, and a wiring structure and the like for a storage element and storage circuit is a matter of design variation for a party skilled in the art.